

**A FOSSIL SOLPUGID, *HAPPLDONTUS PROTERUS*,
NEW GENUS, NEW SPECIES (ARACHNIDA: SOLPUGIDA)
FROM DOMINICAN AMBER**

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Abstract.—A new genus and species of fossil solpugid, *Happlodontus proterus*, is described from Dominican amber. This is the first Tertiary record for the order, the second described fossil solpugid and the first solpugid fossil described from amber. On the basis of this fossil and the present distribution of the family Ammotrechidae, phylogenetic aspects of the group are discussed.

The windscorpions or Solpugida (=Solifugae) compose an order of the Class Arachnida characterized by large forwardly directed chelicerae, stout pedipalpi with a blunt end bearing an adhesive organ, slender, tactile front legs, clear abdominal segmentation and presence of malleoli (racket organs) on the fourth legs (Petrunkevitch, 1955; Roewer, 1934). Their distribution is mainly tropical and subtropical with most species found in Africa. They are among the fastest invertebrate runners which enables them to be effective predators of other small animals.

The fossil record of the Solpugida has, up to the present, been limited to a single species, *Protosolpuga carbonaria* Petrunkevitch (1913) from the Pennsylvanian of North America (ca. 285-320 million years ago). This paper describes the second known fossil solpugid which represents the only known specimen from Tertiary deposits (ca. 25-40 mya) and the first known solpugid in amber.

MATERIALS AND METHODS

The piece of amber containing the solpugid was made available to us by Dr. James Truman, Department of Zoology, University of Washington, Seattle. The amber was roughly obovate in outline, measuring 42 mm in length by 27 mm in width and 6 mm in depth. It was mounted within a silver frame in the form of a pendant. The weight of the amber and mounting was 10 grams. The amber was clear and yellow and the solpugid was clearly visible toward the wider end.

The piece of amber originated from mines in the Cordillera Septentrional of the Dominican Republic. These mines are located in the Altimira facies of the El Mamey Formation which is a shale-sandstone interspersed with conglomerate of well rounded pebbles dating from the Upper Eocene (Eberle et al., 1980). Additional studies indicate that the ember in these mines ranges from the Lower Miocene (25 my) to the Upper Eocene (40 my) in age (Lambert et al., 1985).

Table 1. Measurements of *Happlodontus proterus* gen. n. sp. n.

Character	Measurement (mm)
Chelicera	
Length, width	1.60, 0.42
Propeltidium	
Length, maximum width	1.09, 0.92
Diad width	0.25
Pedipalpus	
Trochanter length, width	0.34, 0.13
Femur length, width	0.84, 0.25
Tibia length, width	1.34, 0.17
Metatarsus length, width	0.97, 0.17
Tarsus length, width	0.29, 0.17
Abdomen	
I Length, width	0.38, 0.50
II Length, width	0.28, 0.71
III Length, width	0.50, 0.92
IV Length, width	0.29, 0.88
V Length, width	0.46, 0.92
VI Length, width	0.67, 1.13
VII Length, width	0.67, 0.97
VIII Length, width	0.34, 0.88
IX Length, width	0.34, 0.55
X Length, width	0.21, 0.46
Total length	6.83

RESULTS

Happlodontus, new genus

Order Solpugida Leach, 1815 as defined by Petrunkevitch (1955)

Family Ammotrechidae Roewer, 1934

Subfamily Ammotrechinae Roewer, 1934

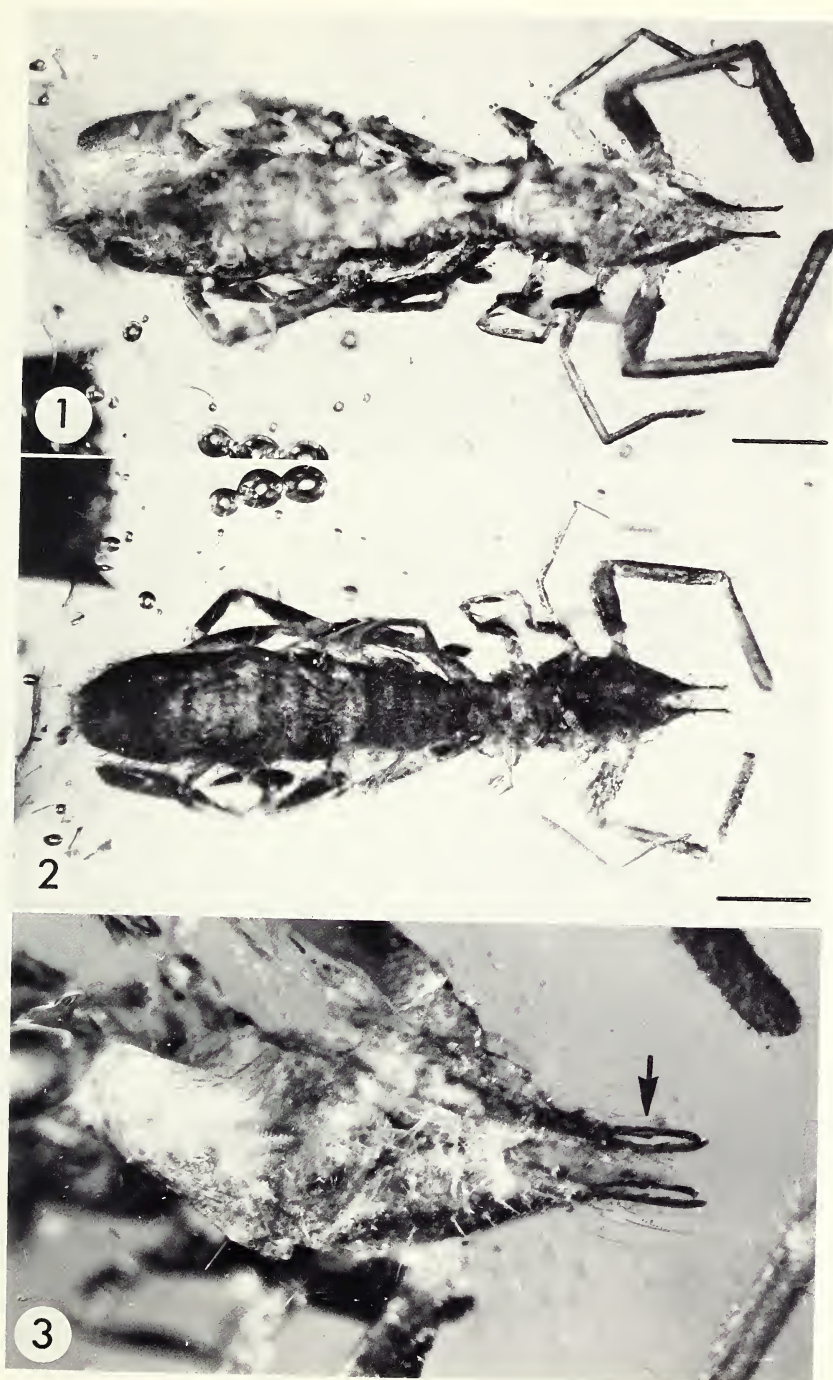
Description. Movable finger of chelicerae with a single major tooth; fixed finger with three distinct teeth, fingers relatively slender; claws absent on first pair of legs, present on legs 2-4; tarsi on legs 2-3 composed of a single segment; tarsi on leg 4 with 3 segments; ventral spinelike setae on distal segment of tarsi 4 vary from one to six; anus subterminal.

Type species. *Happlodontus proterus*, new species, by monotypy. Specimen deposited in the private collection of James W. Truman, Seattle, Washington.

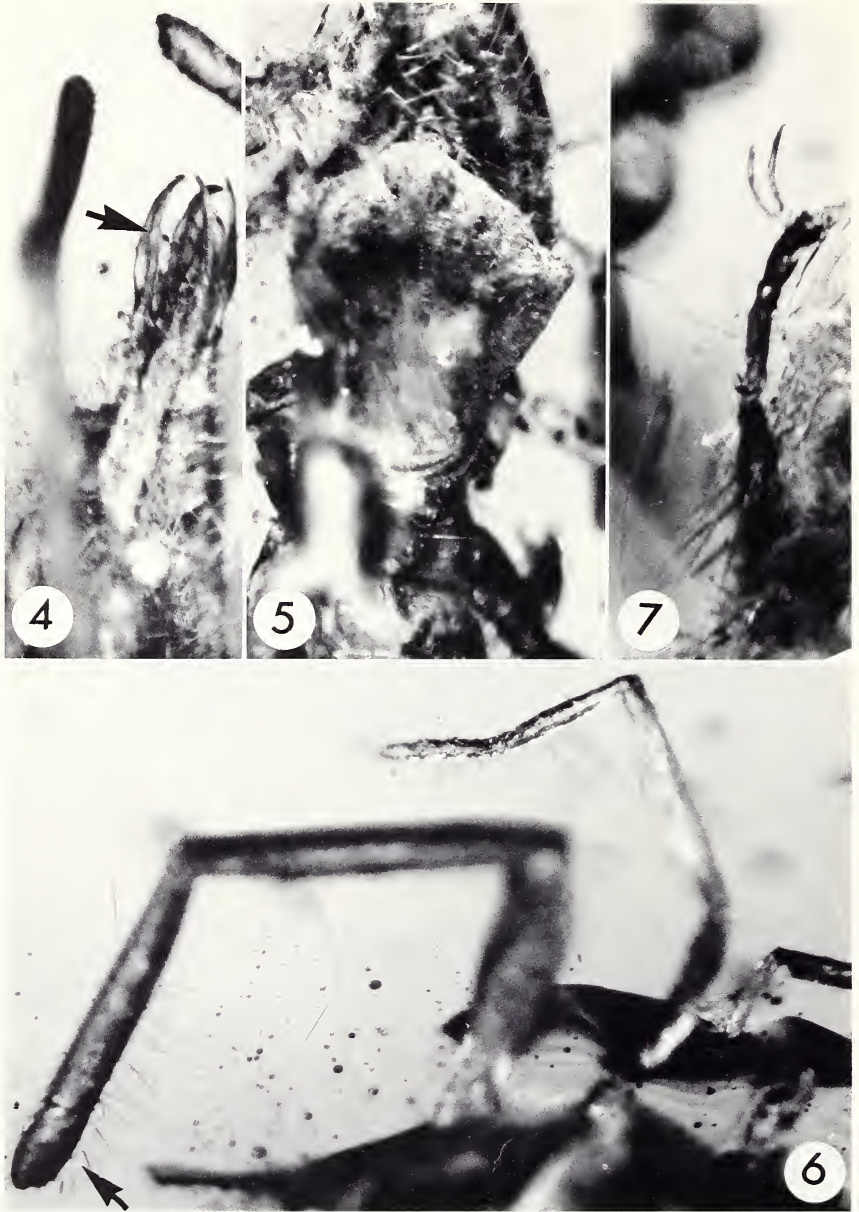
Happlodontus proterus, new species

Figs. 1-12

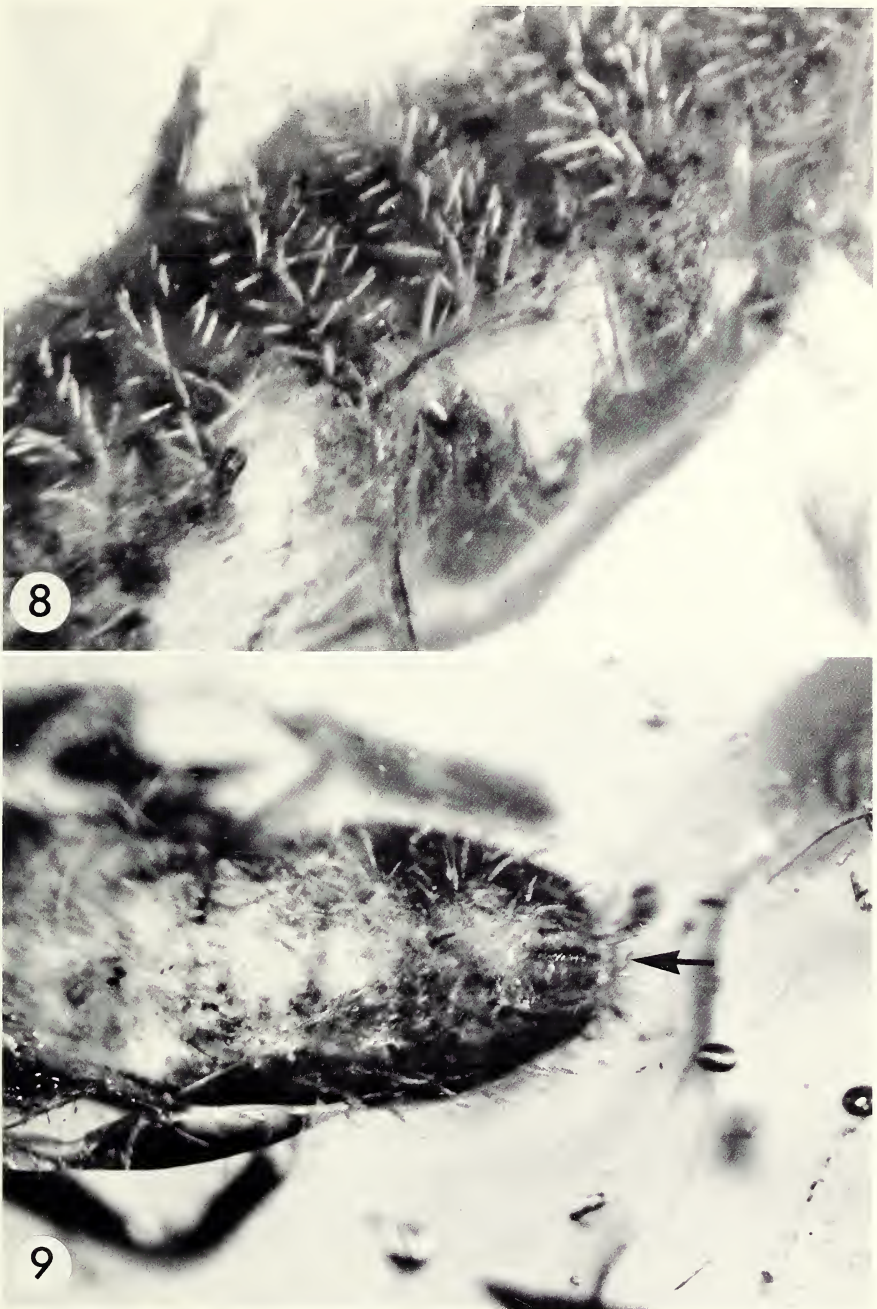
Type data. From Cordillera Septentrional, Dominican Republic. Estimated age, 25-40 million years.



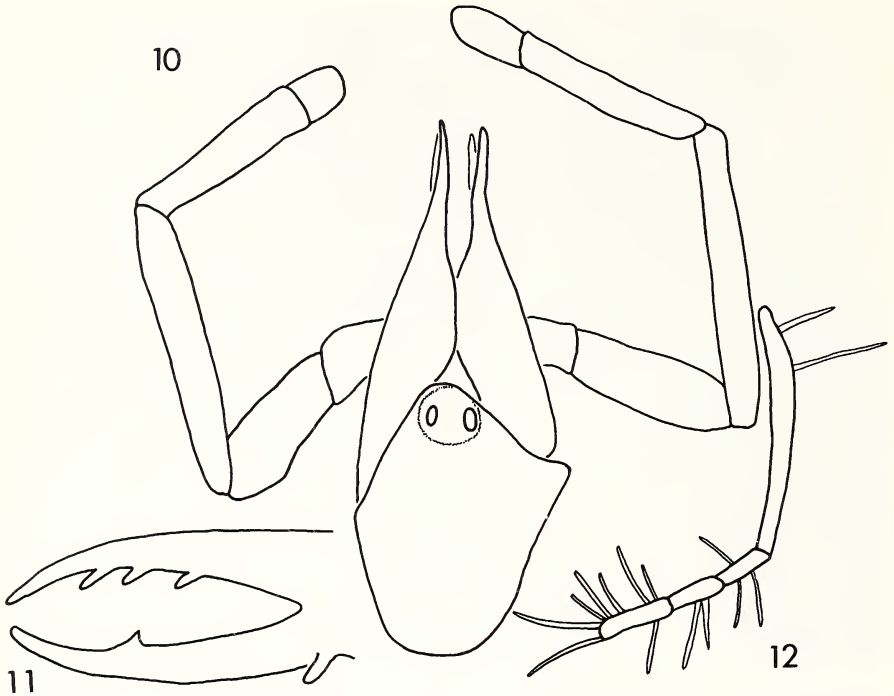
Figs. 1-3. 1. Dorsal view of *Happlodontus proterus*. 2. Ventral. 3. Chelicera, dorsal, slightly laterally (arrow shows single ventral tooth).



Figs. 4-7. 4. Chelicera, lateral (arrow shows single ventral tooth). 5. Propeltidium. 6. Pedipalpus and distal segments of right leg. Arrow points tarsus of pedipalpus. 7. Distal segments, right leg 4.



Figs. 8, 9. 8. Abdominal sternites setation. 9. Subterminal anus (arrow), ventral view.



Figs. 10-12. 10. Dorsal view of propeltidium and anterior appendages. 11. Retrolateral view of left chelicera. 12. Distal segments, left leg 4.

Description. With the characters of the genus. Body form as in Figures 1 and 2. Overall coloration pale brown. Measurements as in Table 1.

Chelicera. Fingers attenuated distally, darker; with all teeth distinct, well developed (Figs. 3, 4, 11) and a tubercle located retrolaterally, near base of movable finger (Fig. 11). *Propeltidium.* Anterior margin convex; scarcely hirsute (Figs. 5, 10). *Pedipalpus.* Hirsute; tarsi and metatarsi with several setae much longer and stronger than others but lacking ventral spine-like setae and claws (Figs. 6, 10). *Legs.* Count of spine-like setae on terminal tarsomeres as follows: leg 1-0, leg 2-5, leg 3-5(?), leg 4- from 1-6; as illustrated in Figures 6, 7, 12. Counts not given could not be obtained. (See Discussion for usefulness of this character.) *Abdomen.* Hirsute; sternite setae arranged in three primary transversal rows located anteriorly, medially and posteriorly (Fig. 8); sternites without comb-like setal groups; genital operculi and other modifications on anteroventral region obscure. Anus subterminal, bioperculated (Fig. 9).

Discussion. Discovery of a solpugid in amber is interesting because normally this group is associated with hot, dry habitats. However, this find suggests that the arboreal habit known today in some of the Central American species was already established in the Tertiary.

Although *H. proterus* is considered a juvenile, the adults were probably relatively small, which could be advantageous in an arboreal habitat. The size of solpugids

varies from 9 to 70 mm (Petrunkevitch, 1955) and the fossil specimen (6.8 mm) probably represents an advanced juvenile stage. According to Muma (personal communication, June 1988), the number of teeth on the chelicerae does not change from one stage to another or immatures to females nor does the number of ventral tarsal spines differ between juveniles and adults. Extant species with a single major tooth on the ventral finger are unknown.

The fossil species does illustrate the wide variation that can occur regarding the number of spines on the fourth and other tarsal segments. If such variation can occur on the same individual, then the wide use of tarsal spination for the determination of solpugid genera and species is questionable, unless variability studies are first undertaken.

The extant distribution of West Indian solpugids includes representatives of the four genera: *Ammotrechella* Roewer, 1934; *Ammotrechona* Roewer, 1934; *Ammotrecha* Banks, 1900; and *Ammotrechinus* Roewer, 1934 of the Ammotrechidae (Muma, 1970, 1987). This report represents the first solpugid from the Dominican Republic although Roewer (1934) reported *Ammotrechinus gryllipes* (Gervais) from Haiti.

There are some curious distributional patterns of solpugids. They are most speciose in Africa (Muma, 1976) and that continent may have been their center of origin. However, there are no known records in Madagascar. They occur in dry, subdesert regions in the New and Old World but are absent in Australia. Representative of the families Eremobatidae Roewer, 1934, Ammotrechidae Roewer, 1934, Mummiciidae Roewer, 1934 and Daesiidae Roewer, 1934 occur on the American continent (Maury, 1984). Muma (1971) described the Amacataidae from Chile but Maury (1980) synonymized it with Daesiidae. Representatives of the first two (with some 25 genera) are uniquely Nearctic. Representatives of the last two families also occur in Africa, Arabia, Asia Minor, Persia and Spain (Millot and Vachon, 1949). It would appear that the Ammotrechidae constitute a phylogenetically recent group which evolved no earlier than the late Mesozoic after the African and South American continents had separated.

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